

What is claimed is:

1. A device stage assembly that moves a device relative to a mounting base, the device stage assembly comprising:

5 a device stage that retains the device;
 a mover housing;
 a support assembly that moves the device stage relative to the mover housing, the support assembly including at least four, spaced apart Z device stage movers that are connected to the device stage; and
10 a control system that controls the Z device stage movers to inhibit deformation of the device stage during movement of the device stage by the Z device stage movers.

2. The device stage assembly of claim 1 wherein the control system
15 controls the Z device stage movers to inhibit dynamic deformation of the device stage during movement of the device stage by the Z device stage movers.

3. The device stage assembly of claim 1 wherein the control system
20 controls the Z device stage movers to minimize static deformation of the device stage.

4. The device stage assembly of claim 1 wherein the control system
controls the Z device stage movers to adjust the position of the device stage relative
to the mover housing along a Z axis.

25 5. The device stage assembly of claim 1 wherein the control system
 controls the Z device stage movers to adjust the position of the device stage relative
 to the mover housing along a Z axis, about a X axis, and about a Y axis.

30 6. The device stage assembly of claim 5 wherein the support assembly
 includes an X device stage mover that is controlled by the control system to move
 the device stage relative to the mover housing along an X axis.

7. The device stage assembly of claim 5 wherein the support assembly includes a first X device stage mover, a second X device stage mover and a Y device stage mover that are controlled by the control system to move the device stage relative to the mover housing along the X axis, along the Y axis, and about the
5 Z axis.

8. The device stage assembly of claim 1 further comprising a bending sensor that monitors the bending of the device stage.

10 9. The device stage assembly of claim 8 wherein the control system controls the Z device stage movers to minimize the bending measured by the bending sensor.

15 10. The device stage assembly of claim 1 including a stage mover assembly connected to the mover housing, the stage mover assembly moving the mover housing with at least one degree of freedom relative to the mounting base.

11. An exposure apparatus including the device stage assembly of claim 1.

20 12. The exposure apparatus of claim 11 further comprising (i) a stage base that supports the mover housing, and (ii) a base support assembly that moves the stage base relative to the mounting base, the base support assembly including at least four, spaced apart Z base movers that move the stage base relative to the mounting base and wherein the control system controls the Z base movers to inhibit
25 bending of the stage base during movement of the base stage by the Z base movers.

13. The exposure apparatus of claim 12 including a base bending sensor that monitors the bending of the stage base.

14. The exposure apparatus of claim 11 further comprising (i) an apparatus frame that supports a portion of the device stage assembly above the mounting base, and (ii) a frame support assembly that moves the apparatus frame relative to the mounting base, the frame support assembly including at least four, spaced apart
5 Z frame movers that move the apparatus frame relative to the mounting base and wherein the control system controls the Z frame movers to inhibit bending of the apparatus frame during movement of the apparatus frame by the Z frame movers.

15. The exposure apparatus of claim 14 including a frame bending sensor
10 that monitors the bending of the apparatus frame.

16. A device manufactured with the exposure apparatus according to claim
11.

15 17. A wafer on which an image has been formed by the exposure
apparatus of claim 11.

18. A support assembly that supports and moves a stage relative to a
mounting base, the support assembly comprising:

20 a plurality of spaced apart Z stage movers that are connected to the
stage; and

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a control system that controls the Z stage movers to move the stage
while inhibiting dynamic bending of the stage during movement of the stage
by the Z stage movers.

25 19. The support assembly of claim 18 including at least four spaced apart
Z stage movers.

20. The support assembly of claim 18 further comprising a bending sensor
30 that monitors bending of the stage.

21. The support assembly of claim 19 wherein the control system controls
the Z stage movers to minimize the bending measured by the bending sensor.

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22. The support assembly of claim 18 wherein the Z stage movers are controlled by the control system to move the stage along a Z axis, about a X axis, and about a Y axis.

5 23. The support assembly of claim 22 further comprising a first X stage mover, a second X stage mover and a Y stage mover that are controlled by the control system to move the stage along the X axis, along the Y axis, and about the Z axis.

10 24. The device stage assembly for mounting a device, the device stage assembly including the support assembly of claim 18, and a stage that retains the device.

15 25. An exposure apparatus including the device stage assembly of claim 24.

20 26. A device manufactured with the exposure apparatus according to claim 25.

25 27. A wafer on which an image has been formed by the exposure apparatus of claim 25.

30 28. A base stage assembly including a stage base and the support assembly of claim 18 connected to the stage base.

35 29. The base stage assembly of claim 28 including a base bending sensor that monitors the bending of the stage base.

40 30. A frame stage assembly including an apparatus frame and the support assembly of claim 18 connected to the apparatus frame.

45 31. The frame stage assembly of claim 30 further comprising a frame bending sensor that monitors the bending of the apparatus frame.

32. A method for making a device stage assembly that moves a device relative to a stage base, the method comprising the steps of:

providing a device stage that retains the device;

providing a mover housing;

5 connecting a support assembly between the device stage and the mover housing, the support assembly including a plurality of spaced apart Z device stage movers that move the device stage relative to the mover housing; and

10 connecting a controller with the plurality of spaced apart Z device stage movers, the controller controlling the Z device stage movers to inhibit dynamic bending of the device stage during movement of the device stage by the Z device stage movers.

15 33. The method of claim 32 wherein the step of connecting a support assembly including providing a support assembly that includes at least four spaced apart Z device stage movers.

20 34. The method of claim 32 wherein the control system controls at least one of the Z device stage movers to adjust the position of the device stage relative to the mover housing along a Z axis, about a X axis, and about a Y axis.

25 35. The method of claim 32 further comprising the steps of connecting a bending sensor with the control system, the bending sensor monitoring the bending of the device stage.

30 36. The method of claim 35 wherein the control system controls at least one of the Z device stage movers to minimize the bending measured by the bending sensor.

37. The method of claim 32 including the step of connecting a first X device stage mover, a second X device stage mover and a Y device stage mover to the device stage, the X device stage movers and the Y device stage mover being controlled by the control system to move the device stage relative to the mover housing along an X axis, along a Y axis and about a Z axis.

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38. A method for making an exposure apparatus that forms an image on a wafer, the method comprising the steps of:

providing an irradiation apparatus that irradiates the wafer with radiation to form the image on the wafer; and

5 providing the device stage assembly made by the method of claim 32.

39. A method of making a wafer utilizing the exposure apparatus made by the method of claim 38.

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10 40. A method of making a device including at least the exposure process, wherein the exposure process utilizes the exposure apparatus made by the method of claim 38.

15 41. A method for driving a stage assembly that moves a stage relative to a base member, the method comprising the steps of:

determining a driving force that inhibits deformation of the stage during movement of the stage; and

20 providing the driving force to the stage to cause the movement of the stage.

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